20. The following table gives the number of units of production per day turned out by four different types of machines:

Employee	Type of Machines			
	M_1	M_2	M_3	M_4
E_1	40	36	45	30
E_2	38	42	50	41
E_3	36	30	48	35
E_4	46	47	52	44

Using Analysis Of Variance (a) test the mean production is the same for four machine and (b) test the hypothesis that the employee do not differ with respect to mean productivity.

APRIL/MAY 2023

DCM14/DCP13/GCM14/GCP13 — ADVANCED BUSINESS STATISTICS

Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State the advantages of multiple correlation analysis.

2. Point out the limitations of partial correlation.

3. A bag contains 6 Red, 5 Black and 3 Green balls. What is the probability of getting a red or green ball at random in a single draw?

4. If on an avenge 8 ships out of 10 arrive safely at Tuticorin port, find the mean and standard deviation of the ships arriving safely out of total of 1600 ships.

5. Examine the factors which determine the sample size.

6. In 324 throw of a six faced ice, odd point appeared 180 times. Would you say that the dice is fair at 5 per cent level of significance?

7. Define Chi-square test.

8. Write a note on Yates' correction.

9. What are the assumptions of Analysis of Variance?

10. State the assumptions of F test.

SECTION B — (5 × 5 = 25 marks)

Answer ALL questions.

11. (a) On the basis of observations made on 39 cotton plants, the total correlation of yield of cotton (X_1), number of bolls that is see vessels (X_2) and height (X_3) are found to be : $r_{12} = 0.8$; $r_{13} = 0.65$; $r_{23} = 0.7$.

Comment on the partial correlation between yield of cotton and the number of bolls, eliminating the effect of height.

Or

(b) If $r_{12} = 0.77$, $r_{13} = 0.72$ and $r_{23} = 0.52$, find the partial correlation coefficient $r_{12.3}$ and multiple correlation coefficient $R_{1.23}$.

18. A company arranging an intensive training course for its team of salesmen. A random sample of 10 salesmen was selected and the value in ('000) of their sales made in the week immediately before and after the course are shown in the following table:

Salesman	1	2	3	4	5	6	7	8	9	10
Sales before	12	23	5	18	10	21	19	15	8	14
Sales after	18	22	15	21	13	22	17	19	12	16

Test whether there is evidence of an increase in mean sales.

19. A firm selling four products is interested in finding our whether the sales are distribute similarly among four general classes of customers. A random sample of 400 sales records provides the following information:

Customer Group	Product				
	1	2	3	4	Total
Partners	25	10	30	15	80
Factory workers	32	20	10	28	90
Businessmen	35	48	25	40	148
Professional	28	22	15	17	82

Formulate a suitable hypothesis. Apply chi-square test. What conclusion can you draw form the test results?

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Find the multiple linear regression equation of X_1 on X_2 and X_3 from the data relating to three variables given below:

X_1	4	6	7	9	13	15
X_2	15	12	8	6	4	3
X_3	30	24	20	14	10	4

17. When the first proof of 200 pages of an encyclopedia of 5,000 pages was read, the distribution of printing mistake was found to be as shown in the first and second columns of the table below. Fit a passion distribution to the frequency distribution of printing mistakes. Estimate the total cost of correcting the whole encyclopedia by using information given in the first and third columns of the table below:

No of misprint in a page	Frequency	Cost of detection and Correction per page
0	113	1.00
1	62	2.50
2	20	1.50
3	3	3.00
4	1	3.50
5	1	4.00

12. (a) From a computer tally based on employer records the personnel manager of a large manufacturing firm find that 15 per cent of the firm's employees are supervisors and 25 per cent of the firm's employees are college graduates. He also discovers that 5 per cent of the firm employees are both supervisors and college graduates. Suppose that an employee is selected at random from the firm's personnel record, what is the

(i) Probability of selecting a person who is both a college graduate and a supervisor.

(ii) Probability of selecting a person who is neither a supervisor nor a college graduate.

Or

(b) The income of the group of 10,000 person was found to be normally distributed with mean = Rs. 750 p.m and standard deviation = Rs. 50. Show that of this group about 95% had income exceeding Rs. 668 and only 5% had income exceeding Rs. 832. What was the lowest income among the richest 100?

13. (a) Explain the different methods of sampling. What are the sampling errors and how do you eliminate them?

Or

(b) Sample of two different types of bulbs were tested for length of life and the following data were obtained:

	Type I	Type II
Sample size	8	7
Sample mean	1234 hrs	1136 hrs
Sample standard deviation	36 hrs	40 hrs

Is the difference in the means significant? (Give that the significant value of t at 5% level of significance for 13 df is 2.16)

14. (a) In an experiment on immunization of cattle from tuberculosis, the following results were obtained:

	Affected	Not affected
Inoculated	12	26
Not inoculated	16	6

Calculate chi square test and discuss the effect of vaccine in controlling suspecting to tuberculosis (5% value of chi-square for one degree of freedom 3.84)

Or

(b) In an anti malaria campaign in a certain area, quinine was administered to 812 persons out of a total population of 3, 248. The number of fever cases is shown below:

Treatment	Fever	No Fever	Total
Quinine	20	792	812
No Quinine	220	2,216	2,436
Total	240	3,008	3,248

Discuss the usefulness of quinine in checking malaria.

15. (a) The following data presents the yield in quintals of common ten subdivisions of equal area of two agricultural plots:

Plot 1 6.2 5.7 6.5 6.0 6.3 5.8 5.7 6.0 6.0 5.8

Plot 2 5.6 5.9 5.6 5.7 5.8 5.7 6.0 5.5 5.7 5.5

Test whether two samples taken from two random populations have the same variance (5% point of F for $V_1 = 9$ an $V_2 = 9$ is 3.18)

Or

(b) In a sample of 8 observations the sum of squared deviation of items from the mean was 84.4. In another sample of 10 observations the value was found to be 102.6. Test whether the difference is significant at 5% level.

You are given that 5% level, critical value of F for $V_1 = 7$ and $V_2 = 9$ degree of freedom is 3.29 and for $V_1 = 8$ and $V_2 = 10$ degree of freedom, its value is 3.07.